The invention claimed is:

1. Cargo loss detection apparatus for a liquid cargo container and comprising:

first and second parallel vertical pipes,

the first pipe having a lower end adapted for submersion in liquid cargo in the container, and said first pipe having a valve which can be opened to admit cargo from the container into the first pipe for movement of a portion of the cargo upward in the first pipe to the level of the surface of the cargo around the first pipe outside of the pipe, and the valve being operable when actuated to close to prevent movement of cargo out of the first pipe when the level of the surface of the cargo around the first pipe decreases,

the second pipe having a lower end adapted for submersion in the said liquid cargo in the container and the second pipe being adapted to admit a portion of the cargo to flow upward into said second pipe to the said level of the surface of the cargo around the first pipe;

a first float in said first pipe and having a first magnet;

a second float in said second pipe and having a second magnet;

first and second parallel vertical tubes received through said first and second floats, respectively, each of said floats being floatable on the portion of the cargo in the pipe in which the float is located, and each float being movable lengthwise of the said tube received through the float;

first and second float followers located in said first and second tubes and movable lengthwise in said first and second tubes, respectively;

third and fourth magnets connected to said first and second float followers, respectively, and magnetically suspended by said first and second magnets, respectively, whereby said float followers are suspended in their respective tubes by said floats;

first and second float follower level recognition devices atop said first and second tubes, respectively, to establish a float relationship reference when both floats have reached a stabilized relationship in cargo admitted to the same level in both pipes, and to sense a variation from said relationship reference in response to a change from said stabilized relationship when cargo has been lost from said container; and

a comparator coupled to said recognition devices and responsive to a sensed variation from said relationship reference.

2. The apparatus of claim 1 and wherein:

said recognition devices comprise lasers having output coupled to said comparator.

3. The apparatus of claim 1 and wherein:

said recognition devices comprise ultrasonic devices having outputs coupled to said comparator.

4. The apparatus of claim 1 and wherein:

said recognition devices comprise reels storing filaments connected to said float followers.

5. The apparatus of claim 4 and wherein:

said comparator comprises a magnet coupled to one of said reels and a magnetically-operated switch coupled to another of said reels.

6. The apparatus of claim 1 and further comprising:

a valve actuator extending in a direction away from said valve toward at least one of said float follower level recognition devices and having a valve mover force input member thereon adjacent one of said float follower level recognition devices;

said valve having a movable sealing member coupled to said actuator, and said valve having a stationary sealing member including a port communicating with the interior of said first pipe, said actuator being operable, when actuated to establish cooperation of said movable and stationary sealing members to terminate communication between cargo in said first pipe and cargo around the outside of said first pipe.

7. The apparatus of claim 6 and wherein:

said valve is a ball valve with a valve body connected to the lower end of the first tube and having the stationary sealing member therein and having the movable sealing member with a shaft extending laterally of said first pipe and geared to and end of said actuator remote from said force input member.

8. The apparatus of claim 7 and wherein:

said actuator includes a shaft extending parallel to said first pipe and having a gear at one end and wherein the force input member is a handle at the other end.

9. The apparatus of claim 6 and wherein:

said stationary sealing member includes a plate secured and sealed to the lower end of said first pipe, said plate having a portion extending laterally from said first pipe and having an upwardly facing valve seat thereon, said plate having a passageway therein providing communication between said valve seat and the interior of said first pipe.

10. The apparatus of claim 1 and wherein:

said recognition devices are arranged to respond to a change in location of said second float follower relative to said first float follower lengthwise of said tubes.

11. The apparatus of claim 10 and wherein:

said recognition devices comprise lasers having outputs coupled to said comparator.

12. The apparatus of claim 10 and wherein:

said recognition devices comprise devices producing wireless signals and coupled to said comparator.

13. The apparatus of claim 10 and wherein:

said recognition devices comprise reels storing filaments coupled to said float followers; and

said comparator comprises a magnet coupled to one of said reels and a magnetically operated switch coupled to another of said reels.

14. The apparatus of claim 1 and further comprising:

a valve actuator extending in a direction away from said valve toward at least one of said float follower level recognition devices and having a valve mover force input member thereon adjacent one of said float follower level recognition devices;

said valve having a movable sealing member coupled to said actuator, and said valve having a stationary sealing member including a port communicating with the interior of said first pipe, said actuator being operable, when actuated to establish cooperation of said movable and stationary sealing members to terminate communication between cargo in said first pipe and cargo around the outside of said first pipe.

15. The apparatus of claim 6 and wherein:

said valve is a ball valve with a valve body connected to the lower end of the first tube and having the stationary sealing member therein and having the movable sealing member with a shaft extending laterally of said first pipe and geared to and end of said actuator remote from said force input member.

16. The apparatus of claim 7 and wherein:

said actuator includes a shaft extending parallel to said first pipe and having a gear at one end and wherein the force input member is a handle at the other end.

17. The apparatus of claim 6 and wherein:

said stationary sealing member includes a plate secured and sealed to the lower end of said first pipe, said plate having a portion extending laterally from said first pipe and having an upwardly facing valve seat thereon, said plate having a passageway therein providing communication between said valve seat and the interior of said first pipe.

18. A liquid cargo container and loss detection combination comprising:

a cargo container having a top and at least one opening through the top for access downward into the interior of the container;

liquid cargo in said container;

first and second parallel vertical pipes projecting downward through said opening into said cargo,

the first pipe having a lower end submerged in said liquid cargo in the container and having a valve which can be opened to admit cargo from the container into the first pipe for movement of a portion of the cargo upward in the first pipe to the level of the surface of the cargo around the outside of the first pipe, and the valve being operable when actuated to a closed condition to prevent movement of cargo out of the first pipe when the level of the surface of the cargo around the outside of the first pipe decreases,

the second pipe having a lower end submerged in the said liquid cargo in the container and open to admit a portion of the cargo to flow upward into said second pipe to the said level of the surface of the cargo around the first pipe;

a first float in said first pipe and having a first magnet;

a second float in said second pipe and having a second magnet;

first and second parallel vertical tubes received through said first and second floats, respectively, each of said floats being floatable on the portion of the cargo in the pipe in which the float is located, and the float being movable lengthwise of the said tube received through the float;

first and second float followers located in said first and second tubes, respectively;

third and fourth magnets connected to said first and second float followers, respectively, and magnetically suspended by said first and second magnets, respectively, whereby said float followers are suspended in their respective tubes by said floats;

first and second float follower level recognition devices atop said first and second tubes, respectively, to first measure the distances of said first and second float followers from a reference level and thereby establish relationship reference between the measured distance of said first float follower and the measured distance of said second float follower; and

a comparator coupled to said float follower level recognition devices and responsive to a change in said relationship reference.

19. The combination of claim 18 and wherein:

said recognition devices are arranged to respond to a change in location of said second float follower relative to said first float follower lengthwise of said tubes.

20. The combination of claim 18 and wherein:

the recognition devices comprise devices producing wireless signals and coupled to said comparator.

21. The combination of claim 20 and wherein:

said devices producing wireless signals are lasers.

22. The combination of claim 18 and wherein:

said recognition devices comprise reels storing filaments coupled to said float followers; and

said comparator comprises a magnet coupled to one of said reels and a magnetically operated switch coupled to another of said reels. .

23. The combination of claim 18 and further comprising:

a valve actuator extending in a direction away from said valve toward at least one of said float follower level recognition devices and having a valve mover force input member thereon adjacent one of said float follower level recognition devices;

said valve having a movable sealing member coupled to said actuator, and said valve having a stationary sealing member including a port communicating with the

interior of said first pipe, said actuator being operable, when actuated to establish cooperation of said movable and stationary sealing members to terminate communication between cargo in said first pipe and cargo around the outside of said first pipe.

24. The combination of claim 23 and wherein:

said valve is a ball valve with a valve body connected to the lower end of the first tube and having the stationary sealing member therein and having the movable sealing member with a shaft extending laterally of said first pipe and geared to and end of said actuator remote from said force input member.

25. The combination of claim 24 and wherein:

said actuator includes a shaft extending parallel to said first pipe and having a gear at one end and wherein the force input member is a handle at the other end.

26. The combination of claim 23 and wherein:

said stationary sealing member includes a plate secured and sealed to the lower end of said first pipe, said plate having a portion extending laterally from said first pipe and having an upwardly facing valve seat thereon, said plate having a passageway therein providing communication between said valve seat and the interior of said first pipe.

27. The combination of claim 18 and wherein:

said recognition devices are reels storing filaments connected to said float followers, and said comparator comprises a magnet on one reel and a magnet-responsive switch on the other reel.

28. The combination of claim 18 and wherein:

said recognition devices comprise lasers coupled to said comparator.

29. The combination of claim 28 and wherein:

said comparator is electronic.

30. The combination of claim 29 and further comprising:

an alarm coupled to said comparator.

31. The combination of claim 18 and further comprising:

a valve actuator extending in a direction away from said valve toward at least one of said float follower level recognition devices and having a valve mover force input member thereon adjacent one of said float follower level recognition devices;

said valve having a movable sealing member coupled to said actuator, and said valve having a stationary sealing member including a port communicating with the interior of said first pipe, said actuator being operable, when actuated to establish cooperation of said movable and stationary sealing members to terminate

communication between cargo in said first pipe and cargo around the outside of said first pipe.

32. The combination of claim 23 and wherein:

said valve is a ball valve with a valve body connected to the lower end of the first tube and having the stationary sealing member therein and having the movable sealing member with a shaft extending laterally of said first pipe and geared to and end of said actuator remote from said force input member.

33. The combination of claim 24 and wherein:

said actuator includes a shaft extending parallel to said first pipe and having a gear at one end and wherein the force input member is a handle at the other end.

34. The combination of claim 23 and wherein:

said stationary sealing member includes a plate secured and sealed to the lower end of said first pipe, said plate having a portion extending laterally from said first pipe and having an upwardly facing valve seat thereon, said plate having a passageway therein providing communication between said valve seat and the interior of said first pipe.

35. In a transportation container holding a cargo of liquid, apparatus for detecting loss of some of said liquid from said container and comprising:

first and second pipes in said container, each pipe having upper and lower portions, said lower portions being submerged in said liquid in said container and each pipe having at least one submerged opening in said lower portion providing admission of said liquid from said container through said openings into said pipes to an original level which is the same in both pipes as the level of the said liquid in said container outside said pipes;

said first pipe having at least one valve communicating with said submerged opening in said first pipe lower portion and operable when closed to prevent communication between said liquid in said first pipe and said liquid in said container outside said first pipe after admission of said liquid into said first pipe to said original level; and

means for detection of a difference between the level of admitted liquid in said first pipe and the level of admitted liquid in said second pipe after closure of said valve.

36. The apparatus of claim 35 and wherein:

said means for detection are lasers.

37. The apparatus of claim 36 and further comprising:

at least one window between said lasers and said pipes and enabling passage of signals from said lasers to the surfaces of said admitted liquids in said pipes.

38. The apparatus of claim 37 and wherein:

said window has a top surface and a bottom surface and means for clearing said bottom surface.

39. The apparatus of claim 38 and wherein:

said means for clearing comprise a wiper engaging said bottom surface.

40. The apparatus of claim 35 and further comprising:

a first float located inside said first pipe and a second float located inside said second pipe,

said floats normally floating on said liquid admitted into said pipes, and said second float having a normal elevational relationship to said first float when the level of admitted liquid in said first and second pipes is the same; and

means for detection of a change from said normal elevational relationship of said second float to said first float to a different elevational relationship of said second float to said first float after closure of said valve.

41. The apparatus of claim 40 and wherein:

said means for detection are lasers.

42. Liquid level measurement apparatus for liquid in a holder and comprising:

a holder containing liquid;

a vertical pipe secured to said holder, said pipe being at least partially submerged in said liquid, and said pipe having means for admitting said liquid into said pipe;

a laser for transmitting signals longitudinally in the pipe to impinge on a target in the pipe to be reflected back by said target to said laser; and

a computer coupled to said laser to compare time of transmission of said signals by said laser, with time of reception by said laser of said signals reflected back, and determine the level of the surface of said liquid in said holder.

43. The apparatus of claim 42 and wherein:

said means for admitting is located to enable liquid in the holder to enter and exit the pipe as the quantity of the liquid in the holder increases and decreases, respectively, so that the level of the surface of the liquid in the pipe is the same as the level of the surface of the liquid in which the pipe is partially submerged; and

said target is the surface of said liquid in the pipe.

44. Liquid level measurement apparatus for liquid in a holder and comprising:

a holder for containing liquid;

a vertical pipe secured to said holder, said pipe being arranged for at least partial submersion in said liquid;

a target in said pipe and arranged to rise and fall in synchronism with rise and fall of the surface of liquid in said holder;

a laser for transmitting signals longitudinally in the pipe to impinge on said target in the pipe to be reflected by said target back to said laser; and

a computer coupled to said laser to compare time of transmission of said signals by said laser, with time of reception by said laser of said signals reflected back by said target, and determine the level of the surface of said liquid in said holder.

45. The apparatus of claim 44 and further comprising:

a float associated with said pipe and operable to rise and fall in synchronism with rise and fall of the surface of said liquid in said holder; and

a float follower magnetically coupled to said float and thereby supported by said float;

said target being secured to said float follower to rise and fall as said float rises and falls.

46. The apparatus of claim 44 and further comprising:

a signal transmission tube coupled to said laser for said signals transmitted by said laser into said pipe; and

said pipe having a receiver arranged to receive said transmission tube for providing a passageway for signals produced by said laser, from said laser through said pipe to said target and for return of said laser signals reflected by said target, from said target to said laser.

47. The apparatus of claim 46 and further comprising:

a carrier coupled to said laser for lifting said laser from said receiver on said liquid holder following measurement of the level of the surface of liquid in said holder, and for carrying said laser to a receiver like said first-mentioned receiver but located on another liquid holder to measure the level of the surface of a liquid in said another liquid holder.

48. The apparatus of claim 47 and further comprising;

a viewer on said carrier to display the liquid level measured by the computer.

49. The apparatus of claim 47 and wherein:

said laser is in said carrier; and

said carrier has a handle whereby said carrier is hand portable by one hand by an apparatus operator person.

50. The apparatus of claim 46 and wherein:

said signal transmission tube and said receiver are configured to mate for establishing collinear axes of said transmission tube and said pipe for transmission of signals produced by said laser on said axis, from said laser to said target.

51. The apparatus of claim 50 and wherein;

said transmission tube and said receiver are configured to mate by sliding said tube and said receiver together.

52. The apparatus of claim 51 and wherein:

said transmission tube has a lower end and an upper end; and

said receiver has an upwardly opening socket to receive a portion of said tube adjacent said lower end of said tube to facilitate coupling said carrier to said pipe for transmission and reception of said laser signals, and for de-coupling said carrier from said pipe for transporting to another liquid holder.

53. The apparatus of claim 47 and further comprising:

a pipe cover pivotally mounted to said holder to pivot from a first, receiver-covering orientation, to a second orientation enabling access to said receiver for receiving said transmission tube.

54. The apparatus of claim 53 and further comprising:

a code on the inside of said cover for identifying the holder to which said cover is mounted; and

a code reader mounted to said carrier for reading said code when said transmission tube is received in said receiver.

55. The apparatus of claim 54 and further comprising:

a stop on said carrier and positioned to support said cover in position for reading said code by said code reader when said transmission tube is received by said receiver.

56. The apparatus of claim 46 and further comprising:

an ultrasonic signal transducer;

a second signal transmission tube, said second tube being coupled to said ultrasonic signal transducer, and

said second tube being receivable by said receiver for providing a passageway for ultrasonic signals produced by said transducer, from said transducer through said pipe to said target and for return of said ultrasonic signals reflected by said target, from said target to said transducer.

57. The apparatus of claim 56 and wherein:

said computer is coupled to said transducer to compare time of transmission of said ultrasonic signals by said transducer with time of receipt by said transducer of said ultrasonic signals reflected from said target to provide a measurement representative of the level of the surface of the liquid in the holder, and compare the level measured by the laser to the level as indicated by the transducer, and apply a temperature compensation factor to the level measurement by the transducer to match the level measurement by the laser, and output the temperature corresponding to said compensation factor that achieves the match.

58. The apparatus of claim 57 and further comprising:

a display representing measurement of the level of the surface of the liquid in the holder and the temperature of said atmosphere.

59. The apparatus of claim 57 and further comprising:

a second vertical pipe secured to said holder, said second pipe being arranged for at least partial submersion in said liquid;

a second target, said second target being located in said second pipe and arranged to rise and fall in synchronism with rise and fall of the surface of the liquid in said holder;

said second pipe having a receiver to receive said second signal transmission tube for providing a passageway for signals produced by said transducer, from said transducer to said second target, and for return of said transducer signals reflected by said target, from said target to said transducer.

60. The apparatus of claim 56 and wherein:

said transducer is mounted atop said second signal transmission tube.

61. The apparatus of claim 44 and further comprising:

an ultrasonic transducer coupled to said signal transmission tube and oriented to project ultrasonic signals down through the tube and pipe and receive ultrasonic radiation up through the pipe; and wherein:

said laser is oriented to transmit signals horizontally through an opening in said pipe;

a reflector is provided on said pipe and oriented to reflect laser signals received horizontally and transmit said signals vertically down through said pipe, and receive

signals reflected from said target up through the pipe and reflect the signals horizontally into the said laser; and wherein

said computer is coupled to said transducer to compare time of transmission of said ultrasonic signals by said transducer with time of receipt by said transducer of said ultrasonic signals reflected from said target to provide a measurement representative of the level of the surface of the liquid in the holder, and compare the level measured by the laser to the level represented by the transducer measurement, and apply a temperature compensation factor to the level measurement by the transducer to match the level measurement by the laser, and output the temperature corresponding to said compensation factor that achieves the match.

62. The apparatus of claim 61 and wherein:

said reflector projects into said pipe from a side wall of said pipe and has a laser reflecting surface disposed at about 45 degrees from the path of a beam from the laser to reflect the laser beam downward along the axis of the pipe.

63. The apparatus of claim 61 and wherein:

said reflector is pivotally mounted to the wall of said pipe and is received in a recess in said wall for facilitating ultrasonic transmission of signals along the axis of said pipe; and wherein:

said reflector is pivotal into said pipe to a position disposed at about 45 degrees from the path of a beam from the laser to reflect the laser beam downward along said axis of said pipe

64. The apparatus of claim 61 and wherein:

said reflector is pivotally mounted in the pipe for orientation of a reflecting surface of the reflector from a plane containing the axis of the pipe to a plane at a 45 degree angle to said plane to reflect a beam from the laser downward along the axis.

65. A method of measuring the level of liquid in a tank and comprising:

mounting a laser on the tank;

transmitting signals from the laser vertically down a pipe fixed to the tank onto a target which rises and falls according to the level of the surface of said liquid in the tank;

reflecting the signals from the target up the pipe to reception by the laser; and

using the elapsed time period from transmission to reception to measure the level of said liquid.

66. The method of claim 65 and further comprising:

using the surface of said liquid as said target.

67. The method of claim 65 and further comprising:

using a float in said liquid to cause the target to rise and fall according to the level of said liquid.

68. The method of claim 67 and further comprising:

locating said target inside said pipe;

locating said float outside said pipe; and

magnetically coupling said target to said float.

69. The method of claim 67 and further comprising:

moving the laser from said tank to other tanks in sequence for measuring the levels of liquids in said other tanks.

70. The method of claim 67 and further comprising:

mounting an ultrasonic signal transducer on the tank;

transmitting signals from said transducer vertically down said pipe fixed to the tank onto said target;

reflecting the ultrasonic signals from the target up the pipe to reception by the transducer;

using the elapsed time period from transmission to reception of said ultrasonic signals to measure the level of said liquid;

comparing the level measurement by transducer with the level measurement by the laser; and

applying temperature influenced sound velocity compensation numbers to the measurement by the transducer to adjust the measurement by the transducer to match that by the laser, and providing the temperature number that achieves the match.

71. The method of claim 65 and further comprising:

mounting an ultrasonic signal transducer on the tank;

transmitting signals from said transducer vertically down a second pipe fixed to the tank onto a target in said second pipe;

reflecting the ultrasonic signals from the second target up the second pipe to reception by the transducer;

using the elapsed time period from transmission to reception of said ultrasonic signals by said transducer to measure the level of said liquid;

comparing the level measurement by said transducer with the level measurement by said laser; and

applying temperature influenced sound velocity compensation numbers to the measurement by the transducer to adjust the level measurement by the transducer to match the level measurement by the laser, and displaying the temperature number that achieves the match.

72. The method of claim 71 and further comprising:

exposing said pipes to said laser and ultrasonic transducer by raising a cover movably connected to the tank and carrying said laser and transducer simultaneously to the tank and coupling said laser and said transducer to said pipes.

73. The method of claim 72 and further comprising:

providing a tank-identifying machine-readable code on said cover; and

exposing said code to a code reader when said laser and transducer are coupled to said pipes to relate the level measurements to the tank where the measurements are made.